

Title of the InventionON-CHIP EMULATOR COMMUNICATIONField of the Invention

The present invention relates to a debugging system for an embedded digital processor on a single integrated circuit chip, the chip comprising an on-chip emulation device.

Background to the Invention

A first technique for debugging involves the use of a hardware emulator – software simulating the device being debugged, and running on the host. Although these may run in real time, they only provide limited functionality, and are generally undesirable.

Another technique for debugging embedded digital processors include the use of so-called “on-chip emulator” whose function is to monitor and control the operation of the digital signal processor. Such devices typically have storage capability, and the ability to initiate command and control sequences for the digital processor in response to externally applied signals from a host computer or to detected states of the digital processor.

Communication between the on-chip emulator and the host computer is carried out via a link, which is typically a link designed for the particular situation. As a result, signals over the link are tailored to the particular on-chip emulation device in the interests of efficient debugging.

It is an object of the present invention to at least partially mitigate the difficulties of the prior art.

### Summary of the Invention

According to a first aspect of the present invention there is provided a debugging system comprising a host computer system and a target device, said target device having an embedded digital processor on an integrated circuit chip, an on-chip emulation device coupled to said digital processor, the on-chip emulation device being operable to control said digital processor and to collect information about the operation of said digital processor, the on-chip emulation device having a communication port operable to receive information from and emit information to the host computer system wherein said debugging system further comprises an interface on said integrated circuit chip having a first port connected to said communication port of said on-chip emulation device and a second port connected to a universal serial bus, said host computer system having a universal serial bus port connected to said universal serial bus.

According to a second aspect of the invention there is provided a method of debugging an integrated circuit chip by communicating between application programs running on a host computer system and a device on said integrated circuit chip, the chip comprising digital processing circuitry and on-chip emulation circuitry for communicating with and control of said digital processing circuitry, the on-chip emulation circuitry having a communications port for receiving information from said host computer system and for passing information to said host computer system, the integrated circuit chip further having an on-chip usb interface connected to a target usb port, and the host computer system having a host usb port, the method comprising: converting said host usb port to said target usb port; running a proxy server program on said host computer system, causing a said application program to connect to said proxy server program, whereby said proxy server program connects to said device on said chip via said host and target usb ports.

According to a further aspect there is provided a method of operating an integrated circuit chip having digital processing circuitry and on-chip emulation circuitry for communicating with, and control of said digital processing circuitry, the on-chip

emulation circuitry having a communications port for receiving information from a remote computer system and for passing information to said remote computer system, said integrated circuit chip further having an on-chip usb interface connected to a usb port, the method comprising converting said usb port to the usb port of a host computer, wherein said host computer is capable of Internet connection; running a proxy server process on said host computer; generating a remote procedure call in said chip; transferring said remote procedure call via said usb to said proxy server process; converting said remote procedure call to a socket call; and thereby communicating between said chip and the Internet.

An embodiment of the invention will now be described with reference to the accompanying drawings.

#### Brief Description of the Drawings

Figure 1 shows a schematic diagram of an integrated circuit chip having an on-chip emulator device and a USB interface;

Figure 2 shows a multiprocessor version of the chip of Figure 1 and;

Figure 3 shows a block schematic diagram of a debugging system in accordance with the present invention.

In the various figures, like reference numerals indicate like parts.

#### Description of the Preferred Embodiment

Referring first to Figure 1, an embedded system includes an integrated circuit chip 100 which comprises a processor 10 on said chip. As used herein, the term 'processor' includes microprocessors and digital signal processors. The processor is connected to other component circuitry of said embedded system in a manner known to those skilled in the art.